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ABSTRACT

This study investigated the social behavior patterns of children who worked on a cooperative task. Several ways of increasing interdependence were explored, and the effects of such methods on task performance were determined. Seventy six same-sex triads of fourth and fifth graders were asked to cooperate in making a block-picture on a round board. All conditions included goal-interdependence; they differed systematically in presence of task requirements, task roles, and group roles. Behavior was precoded in various group-oriented and individual-oriented categories. A Productivity Index was constructed. As hypothesized, goal-interdependence alone did not maximize occurrence of cooperative behavior. Performance was poorest when task requirements and role assignments were absent. Pro-social behavior and performance was significantly greater where task requirements, task roles, and group roles were present together. A strong consistent pattern of sex differences was found, with boys showing greater independence from experimental role-inductions. (Author/DP)

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PATTERNS OF INTERDEPENDENCE IN COOPERATIVE WORK OF ELEMENTARY SCHOOL CHILDREN

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Abstract

Patterns of Interdependence in Cooperative Work
of Elementary School Children

Seventy-six like-sexed triads of fourth-and-fifth-graders were asked to cooperate in making a block-picture on a round board. Five conditions were created varying in patterns of interdependence. All conditions included goal-interdependence; they differed systematically in presence of task-requirements, task-roles and group-roles. Behavior was pre-coded in various group-oriented and individual-oriented categories. A Productivity Index was constructed.

As hypothesized, goal-interdependence alone did not maximize occurrence of cooperative behavior. Performance was poorest when task-requirements and role assignments were absent. Pro-social behavior and performance was significantly greater where task-requirements, task-roles and group-roles were present together. A strong consistent pattern of sex differences was found, with boys showing greater independence from experimental role-inductions.

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PATTERNS OF INTERDEPENDENCE IN COOPERATIVE WORK OF ELEMENTARY SCHOOL CHILDREN

During the past half century, various social critics of American education have condemned schools for their relative unconcern with satisfaction of individual learners' personal needs. Others have been equally vocal in complaining about the schools' allegedly excessive emphasis on the individual. Still others opined that training for independence and individuality is sacrificed to classroom demands for conformity. And, there are also demands on schools to train its pupils in skills needed in a participatory democracy.

It stands to reason that, in order to function adequately in a society as complex as ours, individuals need to receive training for both independence and interdependence. Anecdotal reports of classroom atmospheres suggest that, by and large, they mirror our national individualistic ethos (Henry, 1957; Jackson, 1968; Bronfenbrenner, 1970). Training for interdependence is conspicuously absent in most schools and research in this area is similarly sparse and sporadic. Even though there is a substantial body of literature on group processes, it is seldom applied to the analysis of pupil performance. A recent review accounts for this state of affairs in a trenchant analysis of relationships between the field of Social Psychology and Education (Charters, 1973). The present investigation uses social psychological concepts in analysis of social processes among pupils engaged in a cooperative task. It explored several ways of increasing interdependence among participants. Secondly, it determined the effects of such conditions on pupil performance.

Evaluation of Research on Cooperation

Social psychological research in the area of cooperation has been greatly influenced by the conceptualization of Morton Deutsch (1949). His theoretical analysis focuses on individual goal-relationships: mutually exclusive in competition, shared in cooperation. Most subsequent research has been concerned with determining goodness of performance under these two contrasting goal-structures, perhaps at the expense of neglecting some of the important problems inherent in competition as well as cooperation. Our program of research is based on the assumption that theoretical and experimental juxtaposition of cooperation and competition obscures important questions that should be asked about each process separately (Pepitone, 1969). Our first series of studies focused on conditions that stimulated competitive behaviors among elementary school children (Pepitone, 1972). The present study creates experimentally several conditions assumed to facilitate occurrence of cooperative behaviors.

The Deutsch conceptualization may be taken to imply that mere provision of a work-situation in which shared aims are likely to exist will produce cooperative group interaction toward the shared goals. In fact, employment of the "project method" in educational settings may rest on precisely such a belief in goal-commonality as a sufficient condition for cooperation. An early exploratory study of elementary school children (Stendler, Damrin, Haines, 1951) casts doubt on such an assumption: given a common goal with the task to paint a mural, some pupils withdrew, others only helped best friends, while still others did the lions share of the work for the group, but worked by themselves. A recent study in our program demonstrated that, even in a work-situation where a strong group goal

exists, third graders will compete with each other, depending on the similarity of their task-assignments (Hannah, 1970).

Current research is beginning to concern itself with more precise analysis of variables within either competitive or cooperative goal structure situations. It is noteworthy that most of these investigations approach their problem by considering the task-structures involved. For instance, competitive motivation is examined as a function of complexity of task (Gifford, 1972). In cooperative conditions, such task-analysis poses additional problems which stem from the goup processes which occur when several individuals are working on a common task. A recent review categorizes cooperative tasks into those that require as outcomes a common product vs. those that allow for cooperative interaction but demand individual final products (Thompson, 1972). Only a few investigations could be located by the reviewer in which it was possible to categorize tasks in this manner, and these were field studies in relatively uncontrolled educational settings. They proved inconclusive, partly because as Thompson points out, no records were kept of the extent to which pupil interaction actually took place. Still another series of studies employed tasks that could be manipulated to favor either cooperative or competitive goal-structures among two participants, but concern here centered on existence of cooperative or competitive motivation as inferred from a single act of string-pulling (Madsen, 1971). Again, no data were obtained on social processes involved. The most relevant information about social interaction may still be found in the early studies which contract cooperation and competition; they generally conclude that interaction under cooperative goal-structures is more friendly, while under competitive goal-structures

interpersonal hostilities are more frequent (e.g. Deutsch, 1949, Hammond and Goldman, 1961). No single generalization can be made about goodness of performance under these two contrasting conditions, because outcomes seem to be partly a function of the specific nature of work-tasks.

Theoretical Analysis of Varieties of Interdependence in Cooperation

The research reviewed above suggests that progress in understanding relationships between cooperation and performance could lie in the direction of more detailed examination of member interaction during work on specific tasks. The unique aspect of cooperation would seem to be the fact that members must engage in interactions with each other, and that a large proportion of such interactions must be specifically work-related. It follows that members in a cooperative work-situation depend on each others' actions for their success. Conceptually, this is to say that what defines cooperative situations is the particular interdependencies among members. It is, then to the nature of these interdependencies that one must turn for theoretical understandings of processes involved in cooperation.

Deutsch derived hypotheses which predicted specific member behaviors under cooperative conditions from his basis assumption that such conditions create member-interdependence which stems from a goal-structure which is shared by, or held in common with, other members of a group. He also states that interdependence among group-members may arise from sources other than the group goal. This author has extended Deutsch's analysis by selecting the work-task itself as a second source of interdependence of members (Pepitone, 1952). In that early study, performance of college students was investigated under conditions which systematically varied the degree

to which each group member perceived her task as being important to the group. Two criteria were used in defining importance: 1. a criterion of non-substitutability: important acts were defined as those which must be performed in order for the group to succeed, while completely unimportant acts denoted those activities which need not be performed and which hence are completely substitutable; 2. a criterion of contribution to the goal referred to the extent to which progress toward the goal is made possible by performance of the task. By these two criteria, the most important activities needed by a group are those that are essential for the group's success, and performance of which advances the group considerably toward its goal. Evidence was obtained that under conditions of cooperation and differential task-assignments to members, perception of importance of task-assignment increases member-motivation and improves both the quality and quantity of performance. This motive-force was defined as a "sense of responsibility to the group".

The concept of member task-interdependence was developed further in a subsequent study of young female workers in a factory setting (Thomas, 1957). Here, Thomas made members interdependent by dividing labor among them while they performed tasks such that each person's performance served as a means for the performance of tasks by others. In other groups, members were linked together in interdependence only by a common team goal. Theoretical analysis of performance assumed that such division of labor creates member-expectations that others will perform their roles. As in the previous study, such role-expectations, derived from the task, were presumed to heighten motivation in each individual by creating a sense of responsibility to the group.

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Summarizing, we may state that member-interdependence in work-groups may be created in the following ways: a) provision of a common goal; b) perception that certain important tasks must be performed in order for the group to succeed (henceforth referred to as task-requiredness); c) division of labor such that each member is expected to perform specified work which facilitates performance for other members (henceforth referred to as task-roles). The present study explores childrens' performance under these conditions of interdependence. It extends the concept of role-interdependence by adopting the commonly made distinction between member roles which stem from specific work-requirements of the group - task-roles - and those behaviors having to do with the process of working together - group roles (Bales, 1958). It stands to reason that performance of tasks under cooperative conditions would require, or at least benefit by, performance of specific group roles -- for instance, those concerned with eliciting member participation, coordinating diverse member activities, facilitating communication, giving help to needful members, and so forth. We thus assume that yet another way of creating member interdependence is through d) performance of group-roles.

The study which follows created different patterns of member-interdependence based on the four different sources listed above. In each case it was assumed that such interdependence would heighten motivation of members. Further, that if these motivations could be translated into responsible member interactions, the outcome, that is the group's final product, would be affected. Predictions about differential strengths of the hypothesized motives could at this

stage be only speculative. As all groups were presented common work-tasks, members in all conditions were working under conditions of goal-interdependence. And, as all research on cooperation shows, this source of interdependence has powerful effects on member-interaction. Thus, predominantly positive social behaviors were expected under all conditions. Addition of task-requirements was expected to improve performance because the requirements gave members both increased knowledge about the work, and also because requirements were presumed to raise the perceived importance of a task. Two conditions explored the respective effects of task-role assignment and group-role assignment. While there was no basis for differential predictions, performance of both roles may be deemed essential according to the two stated criteria of importance for the group's success. It would follow that a condition which creates member interdependence from the combined sources of group-goal, task-requirements, task-roles and group-roles would show most responsible group interaction and superior performance.

EXPERIMENTAL PROCEDURES AND DESIGN

Procedures and Design

In all major respects, the experimental procedures were identical with those used in our previous studies: groups of three fourth—or fifth-graders were selected at random from a given classroom, taken one group at a time to an unused classroom in the school, and asked to work together on a problem which requires cooperative action for its completion. Group performance measures were obtained and related to the group's social interaction which had been recorded by an observer-pair in pre-coded categories.

Subjects

The sample of 228 Ss was made up of predominantly middle and upper-middle class, white, fourth-and-fifth grade boys and girls from four elementary schools within one suburban school district. Since there were no systematic differences in pupil performance and behavior as a function of school or classroom treatment, data from all schools were combined. Since our previous investigations showed significant sex differences in behavior relevant to the present study, groups were composed of like-sexed Ss and treated separately in the data analysis.

The Work-Situation

The Work-Task consisted of two parts:

a. The Pep Board - a custom-made fourty inch circle of 1/2 inch Duraply, covered with a velvety material, on which a black line indicated separations into pie-shaped thirds:

b. Pattern-blocks from Elementary Science Study Program produced by McGraw Hill & Company. These are 250 variously shaped and colored flat blocks adapted by us so that each piece can adhere firmly to the board, yet is easily removable and placed into different positions.

Each group of three children was brought from the classroom into the experimental room. After the initial instructions were given, Ss assembled around the Pep board where the materials were demonstrated. This was followed by differential instructions given to create the experimental conditions.

The children were allowed to move about freely, to converse with each other, in short to interact with each other without any restriction in order to remove the restraints which usually exist in the classroom against displaying other-oriented behaviors. Ss were allowed fifteen minutes maximally to work on their task.

The completed pattern was then photographed with a Polaroid camera and immediately shown to the children. This served as a reward for the Ss who were praised for their performance and then dismissed. More importantly, this photograph allowed calculation of the group's productivity.

The Measurement of Productivity

Blind ratings were made by two independent judges who scored the quality of the group product along several predetermined dimensions. Each separate subscore was based on one specific task-requirement which had been detailed to the Ss in the procedural instructions. Specific ratings were made along the following dimensions: elaborateness of design; distinctness of theme; commonality of theme;

unification of pattern; balance of pattern, carefulness of execution. The sum of these ratings constituted the overall qualitative index. Agreement among the two raters for each subscore averaged 86%; these differences deviated no more than two points for a given rating and were adjusted by mutual agreement. The range of the total qualitative score could vary from 0 to a maximum of 24. The quantity of work was determined by counting the number of pieces used in the total pattern, 250 being the maximum score possible.

Behavior Observations

A record of the group's work-pattern was kept by the two observers in terms of each S's interrelationship with each of the other two Ss. This was recorded in two mutually exclusive categories: "works for self" and "works for others". The former category was checked whenever S worked by himself with no regard for the work of the other two Ss. By contract, "Works for others" was scored whenever S either worked with another S on the same pattern-part, or worked by himself but did so with his partner's advice and/or consent in order to contribute to the overall pattern. Additionally, the interaction observer recorded the group process into 28 precoded categories. Reliability, determined by Pearson correlations between different observers in previous studies, ranged for the same categories from .79 to .93.

The single categories could be grouped into three major types of behavior: Evaluative behaviors included evaluations of self, others, or of aspects of the product. Negative social behaviors consisted of such behavior as hindering, expressing aggression, ignoring, refusing to help or rejecting help when offered, etc.

Positive social behaviors focused especially on interpersonal helping behaviors which could be either non-verbal as in the manipulation of pieces for another S, and verbal such as making suggestions or offering assistance.

The Experimental Conditions

The experimental variations were created at the beginning of the session in a brief group discussion with E. In all conditions E sat in a small circle with the three Ss, and explained the nature of the work. Ss were asked to "make a big picture together with these block pieces on the board."

The Unstructured Condition served as the basic control condition: no task-requirements were introduced. In fact, to counter possible implications that E harbored expectations in regard to Ss' performance, Ss were told explicitly that they could make anything they wanted, go about working any way they wanted. The only interdependence created was that of a common goal -- "a big picture."

In the Task-Requirements Condition, E introduced additional information about task-requirements. The picture, she explained, needed to have some overall plan and design. Secondly, it needed to be balanced, and thirdly, it needed to be unified. Ss were engaged in conversation for five to ten minutes enlarging upon these requirements, making sure that they were understood.

In the Task-Role Condition, Ss were similarly informed about the requirements of the tasks. In addition, E explained that the group "might find it easier" if each S were responsible for one specific task-requirement, whereupon each S was assigned one of the three task-roles: The Designer, the Balancer, and the Unifier, respectively.

That is, exactly the same requirements were laid down as in the Task-Requirement Condition, only this time each of the members was made responsible for executing one of the requirements. To assure that the nature of each role was understood, each S was asked to describe his or her role-assignment to the group before proceeding to work together. If requirements were not understood E clarified confusions until each S was clearly aware of the activities involved in his/her task.

In the Group-Role Condition, task-requirements were also discussed as in the two task-conditions. But, in addition, E elicited discussion about group-process requirements. Posing questions pertaining to differences between solitary work and group work, E led the discussion to include considerations of interdependence and benefits accrueing from sharing of ideas. The prepared script questioned whether working alone or in a group might produce superior results, and brought out the point that group performance depended on interpersonal communication. Inferences were then made to behavioral proscriptions for the work-session which was about to begin, focused on listening to others as well as on contributing own ideas.

In a fifth condition, conditions III and IV were combined so that each S was given one specific task-role and a general group-role.

Groups were terminated after maximally fifteen minutes' work, the product was photographed, and each S interviewed for a few minutes about his attitude toward a variety of features of the experimental session. Attitudinal scales were presented to each S, and his ratings established with the help of E or the observer.

A summary of the salient characteristics of the five conditions, and of the number of boys' and girls' groups assigned to each condition, is presented in Table I.

Data Analysis

Data were treated in a two-way analysis of variance, so that effects of Sex as well as Condition could be examined for each variable.

TABLE I.

Summary Description of Five Conditions of Cooperation

Condition	Description	Groups N Boys	N Girls	
I Unstructured	Coop Work Structure, Common goal No task-requirements No differentiated task-roles No group roles	6	8	
II Task-Requirements	Coop Work Structure, Common goal Task-Requirements No differentiated task-roles No group roles	7	9	
III Task-Roles	Coop Work Structure, Common goal Task-Requirements Differentiated task-roles No group roles	7	8	
IV Group Roles	Coop Work Structure, Common goal Task-Requirements No differentiated task-roles Group roles	8	8	
V Task Roles + Group Roles	Coop Work Structure, Common goal Task-Requirements Differentiated task-roles Group roles	7	8	
	Total N Groups	35	41	76
	Total N SS	105	123	228

Table II presents the main results of a two-way analysis of variance, comparing mean behavior and performance in the five conditions separately for boys and girls. Mean amounts of all recorded behavior are indicated, subdivided into Social Interactions and Work manipulating pieces. The Work category is subdivided further into the previously-described work-patterns of special interest: Works for Self and Works for Group. Negative Social Behaviors -- Hindering, Aggression, Rejecting, Ignoring -- were virtually absent, as were behaviors characterizing Interpersonal Competition and Evaluations of all kinds. For clarity of presentation, they are omitted from Table II, as is a variety of positive social behaviors which did not differ across conditions. Behavior falling into the category of Helping is shown as an example of the characteristic trend of pro-social patterns in interdependent work.

Performance data are given in Table II in form of mean quality, mean quantity, and the various sub-indices derived from task-requirements.

Table III presents tests of significance for total work-activity for the two major work-patterns and for the two major performance-indices derived from one-way analyses of variance carried out separately for boys and girls, showing all comparisons between conditions which reached statistical significance. For each of the five measures, significances of sex-differences in each condition are also recorded.

Overall Patterns of Social Interaction

In each of the five conditions, Ss spent most of the fifteen minutes' work session manipulating the block pieces. The greatest amount of all recorded social interaction consisted in Helping and

TABLE II

MEAN AMOUNT OF SOCIAL INTERACTION AND PERFORMANCE OF BOYS AND GIRLS GROUPS IN FIVE CONDITIONS OF COOPERATION

CONDITIONS	I Unstructured		II Task Requirements		III Task Roles		IV Group Roles		V Task Roles + Group Roles		F df 1	F df 4	F df 4
SEX	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Sex	Cond.	Sex x Cond.
BEHAVIOR													
Total Behavior	44.33	47.92	50.76	48.11	49.40	49.13	49.70	56.70	45.50	52.58	4.38	2.6[illegible]	1.93
Social Interaction	14.20	10.21	17.40	15.15	14.90	16.25	14.67	20.83	18.19	19.21	0.20	2.9[illegible]	1.85
Work	30.10	37.70	33.30	33.00	35.24	32.88	35.13	35.88	27.38	33.38	7.448	3.9[illegible]	5.04
Works for Self	6.50	22.80	4.60	11.20	16.20	9.50	17.10	9.90	3.30	5.00	1.01	3.46	4.26
Works for Group	23.50	14.80	28.60	20.67	18.05	22.75	17.50	25.50	23.50	27.67	0.00	1.50	2.97
Helps	5.67	3.80	6.81	5.10	5.90	6.50	5.40	7.60	7.50	7.30	0.08	1.68	1.29
PERFORMANCE													
Quality	14.39	12.75	14.86	16.56	15.29	17.75	14.75	18.75	16.00	19.38	7.67	3.78	1.90
Quantity	2.00	3.13	2.86	2.67	2.43	2.13	2.50	2.42	1.90	2.25	1.84	3.18	3.92
Carefulness of Execution	2.83	2.50	2.14	2.67	2.57	3.00	2.63	3.38	2.95	3.25	11.10	6.09	3.32
Elaborateness of Design	2.00	1.86	1.29	1.78	1.57	2.00	1.63	2.38	1.86	2.38	12.44	2.97	1.54
Commonality of Theme	1.67	1.25	1.71	2.00	1.71	2.25	1.25	1.25	2.29	2.75	0.97	6.25	0.98
Overall Balance	1.33	.75	1.43	2.00	2.29	2.00	2.00	2.50	2.00	2.25	0.31	7.29	1.87
Unification	.33	.25	1.29	1.22	.86	2.00	1.00	2.25	1.57	2.00	9.31	8.94	2.65

LEVELS OF SIGNIFICANCE:

X - - - - $p < .05$

XX - - - $p < .01$

XXX - - - $p < .001$

TABLE III

One-Way Analysis of Variance and Tests of Significance between Five Experimental Conditions

Category	Sex	Source		DF	F-ratio	Significance	Significant Comparisons		
Work	Boys	Among Groups	247.228	4	4.73	.002	III vs. V	t=4.42;	p < .001
							IV vs. V	t=4.86;	p < .001
		Between Groups	52.258	100			I vs. II	t=3.08;	p < .05
							I vs. V	t=3.03;	p < .05
	Girls	Among Groups	12.497	4	3.63	.008	Condit. I	t=3.03;	p= .005
							Condit. V	t=3.5 ;	p < .005
		Between Groups	31.024	118					
	B vs. G								
	B vs. G								
Works for Self	Boys	Among Groups	948.342	4	4.23	.004	II vs. IV	t=2.78;	p < .10
							III vs. V	t=2.81;	p < .10
		Between Groups	224.041	100			IV vs. V	t=3.27;	p < .05
							I vs. V	t=3.42;	p < .05
	Girls	Among Groups	1056.943	4	3.746	.007			
		Between Groups	282.179	118					
	B vs. G						Condit. I	t=2.74;	p= <.01
Works for Group	Boys	Among Groups	451.01	4	1.96	.11	n.s.		
		Between Groups	230.72	100					
	Girls	Among Groups	596.965	4	2.611	.04	I vs. V	t=3.18;	p= < .02
		Between Groups	228.646	118					
	B vs. G						Condit. I	t=1.79;	p < .10
							Condit. II	t=1.82;	p < .10
							Condit. IV	t=1.66	p= .10

Continued -

TABLE III

One-Way Analysis of Variance and Tests of Significance between Five Experimental Conditions

Category	Sex	Source		DF	F-ratio	Significance	Significant Comparisons		
Quantity of Product	Boys	Among Groups	3.11	4					
		Between Groups	1.14	100	2.74	.03	II vs. V	t= 3.24	p < .05
	Girls	Among Groups	3.78	4			I vs. III	t= 3.96	p <.005
		Between Groups	.84	118	4.48	.003	I vs. V	t=3.13	p <.05
	B vs. G						Condit. I	t=3.03	p= .005
Quality of Product	Boys	Among Groups	7.72	4					
		Between Groups	35.72	100	.22	n.s.	n.s.		
	Girls	Among Groups	165.280	4					
		Between Groups	22.947	118	7.20	.001	I vs. II	t= 2.96	p < .05
	B vs. G						I vs. III	t= 3.77	p < .005
							I vs. IV	t= 4.47	p < .001
	B vs. G						I vs. V	t= 5.33	p < .001
							Condit. IV	t= 2.92	p= .006
							Condit. V	t= 1.87	p < .10

Accepting Help. As mentioned above, negative social behaviors, including negative evaluative criticisms, occurred only very rarely. We are, then, dealing here with groups who accept the common goal, who are working in an non-evaluative, accepting climate, and who display almost exclusively positive social behaviors characteristic of cooperating groups.

Comparison Among Conditions

We may start by noting the results of the basic control condition in which Ss were given freedom to proceed in any way they wished, without imposition of any kind of required work-structure from E.

The Unstructured Situation

The mean total behavior, as well as the mean social interaction, for both boys and girls, is lower here than in any of the other conditions. Examination of the working patterns in greater detail shows that girls compared both with girls in the four other conditions as well as with boys in the same condition spend a considerably greater amount of their interactions engaged in working. However, as seen in the means for Works for Self and Works for Group, their manipulation of pieces is highly solitary. Comparing now the girls' performance, again both within the condition with boys and across conditions with girls, we note that the girls high rate of work is reflected in their larger quantitative score, but poorer qualitative score. They are outscored by the boys on every performance subscore in this condition. The quality of their work is significantly poorer as compared with girls in any of the other conditions.

The girls' behavior in an unstructured situation with only a common work-goal to unite them may be characterized as follows:

they interact relatively little with each other, work diligently for and by themselves to produce work of relatively poor quality. Compared with the girls, the boys' work-pattern is more group-oriented and their performance is of superior quality. Comparison of boys in Condition I across conditions is more complex and will be taken up at a later point in this analysis.

The Task-Requiredness Condition

Demands that work be performed to meet specified criteria cause both boys and girls to abandon considerably their individual working patterns. There is a decrease in self-oriented work-patterns and a corresponding increase in working for the group, as well as in the Helping category. It may be recalled that task-requirements were specifically intended to increase interdependence. That is, Ss would have to work together to fulfill the demands growing out of the task. This is indeed what seems to have happened.

For the girls, there is a sizeable increase in the average quality of work. It is to be noted that this qualitative improvement in Condition II occurs primarily in the task-required characteristics of the product: balance, unification and commonality of theme.

For the boys, the overall quality of productivity is unaffected; they too respond somewhat to the task-requirements by improving the balance and unification of their design. In contrast with the girls, however, the boys' elaborateness of design is poorer and care in execution suffers also. One might infer that while the boys accepted the work-requirements, such a structure was actually restricting to them, in some respects, whereas it proved helpful to the girls.

The Role-Structure Conditions

Results from the three role-conditions are examined together, because they demonstrate consistent trends. Again, strong sex differences are evident.

As the role-demands for increased interdependence increase in the different conditions, so do girls systematically respond by greater absolute amounts of interaction with each other, increased group-oriented behavior, greater helpfulness, and a systematic increase in mean quality of performance. This trend culminates in Condition V, though it is noteworthy that while behavior and performance differences between Condition II and III, as well as between III and IV are in the expected direction, they do not reach statistical significance.

In Condition IV, where interdependence is created through group roles which require girls to pay attention to each other and to communicate with each other, social interaction is indeed maximal, and helpfulness is greatest. This increased sociability is presumably held in check by knowledge of task-requirements also present in this condition, so that the quality of work is not affected detrimentally. It is suggestive, though, that in this condition Commonality of theme is lowest both for boys and girls; perhaps the group-roles resulted in greater acceptance of diversity of ideas, thus reducing the commonality score. Relevant here is also that whatever minimal amount of negative social behavior was found, occurred primarily in this condition.

In Condition V, where maximal role-interdependence was created, practically no self-oriented work occurs: the girls work almost

exclusively together for the common goal. Their mean quality of performance is highest, and approaches the maximum possible score of 24.

Boys, over the three role-structure conditions, follow a more-or-less invariatle pattern of behavior: they are relatively unresponsive to induction of behavioral role-demands, their performance does not change significantly either when required to assume task-roles, or to assume group roles. In fact, in Condition III and IV there is a trend toward solitary work: mean Works for Self increases from 4.6 in Condition II to 16.2 in Condition III and 17.10 in Condition IV. This finding suggests that boys interpret role-demands by assuming greater individual responsibility. Only when the constellation of role-demands becomes massive -- in Condition V -- do they respond by increase in relevant social behaviors and improved quality of performance. Thus, in the last Condition, they become more similar to the girls in that Condition, and more similar to themselves as they functioned in the Unstructured Condition.

DISCUSSION AND CONCLUSIONS

Social Climate and Cooperation

We have attempted to extend analyses of cooperation which focus on goal-interdependence to include additional sources of interdependence in groups. In the determinants of interdependence among group members one must include the "climate" of the culture in which the groups are working. More particularly, one must look for group standards in regard to competition or cooperation, or, put differently, in regard to individuals working independently or together. Consideration of this type of ideology seems particularly relevant

in school settings where strong standards fostering independence are the rule. In our study, Ss were placed into a situation where social interaction was valued quite explicitly: E attempted actively to remove classroom restraints against social interactions (particularly if they involve noise, movements from assigned seats, etc.). In fact, E made a point of communicating her expectation that Ss would enjoy working together as agroup. Such a positive climate seems a pre-condition for cooperation; its impact cannot be assessed here as it was held constant in all conditions. Repetition of this study in an atmosphere less conducive to interdependent work may very well show quite different results.

Thus, two of the most important variables known to stimulate cooperative behaviors were present in all our conditons: the combination of being placed into a climate which fostered member interaction, and placement into a group which is required to work toward a common goal. The fact that task-and-role-requirements had sizeable effects in this study attests to their importance as additional determinants of cooperative behavior.

Interrelationships between task-requiredness, task-roles and group-roles

It must be kept in mind that this study has singled out only a few of several possible sources of interdependence and manipulated them in an exploratory, overview fashion; detailed in-depth analyses are indicated for next steps based on some of our findings.

A major area of questions concerns relationships between task-requirements and task-roles. We have restricted the term task-requirements to denote accomplishments which must be achieved by performance of the task according to specific criteria. In our

case, the final product had to consist of a common pattern which was balanced and unified. The conventional definition of task-roles was adopted which refers to expected member behaviors by which the task is to be executed, including for the present both how it is to be done and who is to do what. In the literature, notoriously lacking in definitional rigor in this area, these two concepts are usually not distinguished (for further discussion, see Gross et al, 1958). Yet they denote two separate operations since task-requirements are linked to product-measures, while task-roles are measured by member behavior. Recognition of their potential for independent variation should lead to much conceptual clarity and empirical research.

One of the main obstacles in attaining definitional clarity of the two concepts under discussion is the fact that, to date, no criteria exist as to the size of the descriptive unit for either of these concepts.[2] In our study, task-roles were described to Ss on a very general level, which coincided with task-requirements for purposes of experimental control; additionally specified was only the expectation of division of labor as to who must do what. That is, the roles of Balancer, Unifier and Designer were created without stating details of exactly what each person in a given role was to do. It may very well be that because task-roles were defined primarily in terms of task-requirements differences between Conditions II and III did not reach statistical significance. And it might be argued further that differences between the remaining conditions were similarly reduced by the constant presence of task-requirements (the latter were necessary for control purposes).

A second important aspect of task-roles is their function in relation to member interdependence. In this exploration, task-

requirements were designed primarily with a view toward creating member-interdependence and by their very nature created role-interdependencies. That is, in order to have a "balanced" or "common" design, each member's performance had to be related to that of the others. It would appear likely that some tasks will create stronger interdependencies among members than others. One might conceive of, and explore experimentally, a continuum of task-role interdependencies varying from an extremely low task-role interdependence such that division of labor would allow work to be carried out by each member independently, to one where each person's working step is a prerequisite for the other members' step -- obviously the highest degree of task-role interdependence.

Similar analyses must be made of group-roles. Is performance of certain important group-roles essential for work under cooperative conditions, regardless of the nature of the task? Group-roles, even as minimal as were created in our study, orient group members toward each other so that task-required activities may take place. Would it, then, be useful to conceive of "group-requiredness" in the same way as we accept the concept of task-requiredness? If so, perhaps an analogous theoretical distinction might be made between group-requiredness and group-roles. Group-requirednesses for cooperative work would then detail what group-functions are to be performed, including such functions as utilization, coordination and integration of work by different members. Group-roles would denote the behavioral expectations as to how it is to be done and who is to do what. In the study under consideration, group-roles were defined only by laying down a few minimal behavioral expectations in the area of

attending to others and communicating. Again, future studies should and could specify additional group-requirements, assign group-roles to specific members, accompanied by detailed behavioral pro-scriptions.

We suspect that it is the presence of required group-roles that often seems to reduce individual competitive motivations under cooperative work conditions -- a hypothesis with no opportunity for testing in the present study. It is also likely that it is the extent to which skills in execution of group-roles are present that largely determines quality of performance. Without presence of some group-roles, task-roles may be perceived as a personal charge and while heightening personal motivation and responsibility, may lead only to individual effort rather than to greater interdependence. This may have occurred in Condition III, where the boys showed a considerable reduction in working for the group though the same trend in Condition IV is not so readily explained. It is, however, also likely that exclusive enactment of group-roles, at the expense of task-role performance, may hinder the group's accomplishment. This did not happen in Condition IV, probably because of the presence of task-requirements so strong as to create some kind of task-role-expectation in each member. We would posit the necessity for maintaining a delicate balance between these two sets of roles, their relationship probably depending on such factors as specific task-requirements, familiarity of members, their skills in working together, and so forth. Our study has offered clear evidence that performance in cooperative conditions can be improved by the simultaneous presence of task-roles and group-roles.

We have deliberately not considered in this study individual differences in skills available for execution of required tasks,

as well as in ability to respond to role-demands. Obviously, provision of optimum conditions will come to naught, unless there are also present the skills needed for their execution. A recent publication presents a needed systematic categorization of tasks on the basis of requirements which they impose on groups (Steiner, 1972). It permits analysis of relationships between task-requirements, available resources among group members, group process and resulting productive performance. Such a conceptualization would seem to hold great promise for analysis of classroom activities and pupil roles.

Sex differences in behavior and performance

Sex-differences emerged as one of the most interesting, consistent and strongest findings. Briefly, they may be summarized as follows: girls responded to the role-demands created in the different conditions, whereas boys did so minimally. Secondly, when no task-requirements or role-demands were made (Condition I), boys' quality of work was better than that of girls. Corroboration of these differences can be found in several different lines of research. Hoffman has integrated these diverse studies in a theory which relates girls' task-performance to affiliative needs, and that of boys to their orientations toward mastery of problems (Hoffman, 1972). In our Comparison Study which employed the same type of task, boys also performed better than girls, and were more confident in their ability (Pepitone, 1972). If one cares to speculate, one might attribute the boys' superior performance to a spatial factor which is allegedly more developed in boys and may be useful in our task. Or, it might be argued that boys' play school experiences include more block play in small groups which may give

training for the kind of cooperative skills required with pattern blocks. Both of these propositions might lead to the conclusion that boys might react quite differently when faced with different tasks which require different skills than our task.

There is supportive evidence for the contention that the boys' relative unresponsiveness to E's demands might be a function of greater confidence in their work: in a recent study in this series (Torop, 1973), where E offered critical and/or helpful comments, boys tended to ignore her: when criticisms increased in strength, boys became more defensive than girls. Girls were more responsive to E's criticism, and able to utilize E's suggestions for improvement. Similarly, in our earlier study, girls were found to pay more attention to, and presumably were more influenced by, each others' work than were the boys. These findings point to girls' greater "unsureness" about their performance and are in agreement with other data which describe girls' greater anxiety and its deleterious effects on performance (Maccoby, 1972). Might their behavior be different when faced with male experimenters, or with different kinds of role-inductions? These are questions that cannot be answered in this study.

What this study does suggest is that individual properties of learning tasks and their effects on behavior should be examined intensively. Here one may recall that the least amount of social interaction and poorest quality of work for both boys and girls occurred in the Unstructured Condition. This would seem to be an important finding, contrary to current popular Neo-Rousseau-ian notions about "creativity" presemed to be "released" under such con-

ditions of "non-interference". The generality of our finding needs to be explored further; here we can only conclude that a relatively unstructured activity, with few task-required demands made on members of a working group, does not necessarily increase their social interaction or the quality of work.

For educational theory, our study suggests a re-evaluation of the place of cooperative work in school settings. On the one hand, there are value-questions pertaining to the aims and uses of inter-dependent work in classrooms. But aside from these, there are questions pertaining to best fit between nature of learnings and structure of the medium by which mastery is to be attained. Where is individual work most indicated, where work under cooperative conditions? And, if the latter, what is gained by leaving the work-situation unstructured, and what is lost? What task-requirements and role-specializations should be demanded? Should suggested work-patterns differ for boys and girls? And, where in the curriculum is there a place for the instruction of pupils in the necessity for, and use of, group-roles?

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Footnotes:

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2. Theoretical progress in this area would seem to be crucially important in dealing with the concept of "teacher role".